# THE HERSCHELL-STEPHENSON POSTULATE.

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Of the three postulates which I submitted to the Society at its last meeting, I presume the first will generally be considered the most questionable. The hypothesis of Herschel and Stephenson, that the coal consumed under our boilers merely imparts, to the steam, solar energies which have been imprisoned for ages by the molecular attraction of the carbon particles, has been commonly accepted as a beautiful poetical fancy, having, perhaps, some indefinite foundation in truth. Few persons, however, can have indulged the expectation that so vague a surmise would ever yield any satisfactory numerical results, and it will not be strange if even the close coincidences to which it has led me, may be regarded by many as merely accidental.

The following comparisons show the character of the agreement between estimates of solar distance, mass, and parallax, based upon various chemical and astronomical observations:

## I. By Flame Analysis.

| According to Experiments of | Distance. | Mass. | Parallax. |
|---|---|---|---|
| | | | " |
| Andrews | 93,631,000 | 340,950 | 8.73 |
| Favre and Silbermann | 92,471,000 | 338,430 | 8.839 |
| Grassi | 92,466,000 | 328,370 | 8.84 |
| Dulong | 92,363,000 | 327,290 | 8.85 |
| Hess | 92,298,000 | 326,590 | 8.856 |

## II. By Astronomical Computation.

| According to Calculations of | Distance. | Mass. | Parallax. |
|---|---|---|---|
| | | | " |
| Encke | 95,311,000 | 359,630 | 8.576 |
| Liais | 93,309,000 | 337,440 | 8.76 |
| Newcomb | 92,380,000 | 327,480 | 8.848 |
| " | 92,152,000 | 325,040 | 8.87 |
| Stone, corrected | 91,945,000 | 322,900 | 8.89 |
| Hansen | 91,672,000 | 319,990 | 8.9165 |
| Stone | 91,512,000 | 318,320 | 8.932 |
| Leverrier | 91,329,000 | 316,470 | 8.95 |
| Wineke | 91,186,000 | 314,930 | 8.964 |

My own faith in the significance of such coincidences, and in their suggestive value as indications of an instructive, intelligent as well as intelligible, purpose in nature, inclines me to the acceptance of speculations, based on thermodynamic, spectroscopic, and analogous theories, even before all their premises have been recognized as either axiomatic or rigidly demonstrable. The desirableness, however, of completing the

proof as soon as possible, must be admitted, and I now submit some further considerations, which, in my own judgment, impart a more strictly mathematical character to my fundamental postulate.

It is well known that the velocity acquired in falling towards an attractive centre, depends upon the attracting mass and the distance fallen through. In other words,

$$v \propto \sqrt{2gh} \propto \sqrt{\frac{2mh}{d^2}} \propto \frac{2h}{d}\sqrt{\frac{m}{2h}}$$

It is moreover evident that in any perfectly elastic particle, oscillating perpetually in a compound orbit, about two centres of attraction, as in the hypothetical case of water vapor, set in motion by the force of chemical combination, if

$$m \propto 2h,$$

the proportionate velocity communicated by gravity varying as $\sqrt{\frac{2h}{d}}$, the proportionate living force will vary as $\frac{2h}{d}$. The mean amounts of living force imparted by each of the two attracting centres will then tend constantly to equality, thus counteracting any indefinite expansion or contraction towards the centre of prepondering attraction, which would otherwise gradually draw the oscillating body to itself. This exigency can be satisfied, and a perpetual oscillation maintained by the conjoint action of gravity and elasticity, only when $2h$ has the proportional value here indicated.

The question may be approached in another way. The sustaining *vis viva* of the earth in its orbit, having been acquired by a virtual fall through the half-radius $\left(h' = \frac{d'}{2}\right)$, let it be required to find the proportionate part of the possible fall which will sustain the elastic oscillation.

Since the attracting forces (or the virtual masses acting at the point of disturbance), vary as $\frac{m}{d^2}$, the virtual centrifugal forces will vary as $\frac{m}{d}$. Then

$$2h'' : d'' :: \frac{m''}{d''} : \frac{m'}{d'} :: m'' \; d' : m' \; d''$$

$$\therefore 2h'' \propto \frac{m''d'}{m'}; \; \frac{m''}{2h''} \propto \frac{m'}{d'}; \; m \propto 2h \propto d.$$

At whatever distance from the centre the elastic particle encounters an obstacle, a portion of the force must be communicated to the obstacle, originating new molecular motions, which, if they could all be known, would show that the aggregate amount of force is still maintained. The following attempt to trace a portion of the transmitted forces of inter-

rupted oscillations, may perhaps suggest others that will be more complete and satisfactory :

Let $\frac{m'}{m''} = \frac{\text{sun's mass}}{\text{earth's mass}} = 314{,}000$*

$d' = 91{,}328{,}000$

$d'' = 3{,}962.8$

$h'' = \frac{m''d'}{m'} = 290.85$

$v'$ = hourly velocity of a body revolving at the distance $d'$ from the sun's centre, or at the distance $h''$ from the earth's centre, = 65,062.4 miles.

In consequence of the solidity of the earth, the hypothetical perpetual oscillation of the combined H and O through the major axis $2h''$, must be maintained at $d''$ instead of at $h''$ from the earth's centre. Its maximum velocity is therefore only $\frac{2h''}{d''}$ of $v'$, which =9609.36 miles =9.24× the equatorial superficial velocity of rotation, or 9.0165× the velocity at the centre of oscillation of the semi-axis $h$.

The reaction of the elastic atmospheric particles, in their continual rebounds from the earth's surface, under tidal, thermal, chemical, and molecular influences, should contribute, in connection with the motion of revolution, to a rotary motion in the earth itself. The following coincidences, at the boundary lines of the interior (Telluric) and exterior (Jovian) planetary systems, seem to render it probable that a reference to centres of oscillation may ultimately account for the masses, order of arrangement, and times of rotation, of the several planets and satellites, as well as for their period of revolution.

If we assume, in the sun, as well as in the oscillating $H_2O$, a virtual centre of oscillation at the distance $\frac{r}{9}$ from the diametrical centre, the oscillating centre will move about a sphere, which has a volume, proportioned to that of the solar sphere, as 1 to $9^3$.

If all the asteroids, satellites, comets, meteors, and undiscovered planets in our system constitute an aggregate equivalent to the mass of Uranus, the mass of the sun is 729 ($=9^3$) × the planetary mass. (*a.*)

$729 \times \frac{1}{9}$ ($=9^2$) solar radii = distance of Mercury. (*b.*)

$729 \times 1$ ($=9^3$) " " = distance of farthest asteroid. (*c.*)

$729 \times 9$ ($=9^4$) " " = distance of Neptune. (*d.*)

| | Theoretical. | Observed. | Theoretical Error. |
|---|---|---|---|
| *a* | .0013717 | .0013584 | +.009 |
| *b* | 34,430,000 | 35,353,000 | —.027 |
| *c* | 309,870,000 | 312,388,000 | —.008 |
| *d* | 2,788,833,000 | 2,743,216,000 | +.017 |

* The values are taken from Norton's Astronomy.